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- (72) Inventor; and
- (75) Inventor/Applicant (for US only): SANZ MOLINERO, Ana, Isabel [ES/BE]; Bernheimlaan 38, B-9050 Gentbrugge (BE).
- (74) Common Representative: CROPDESIGN N.V.; Technlogiepark 3, B-9052 Zwijnaarde (BE).

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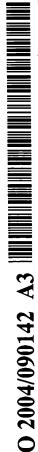
- with international search report
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(54) Title: PLANTS HAVING MODIFIED GROWTH CHARACTERISTICS AND METHOD FOR MAKING THE SAME

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(57) Abstract: The present invention concerns a method for modifying the growth characteristics of plants by modulating expression in a plant of a nucleic acid sequence encoding a metallothionein and/or modulating activity in a plant of a metallothionein. The invention also relates to transgenic plants having modified growth characteristics, which plants have modulated expression of a nucleic acid encoding a metallothionein.



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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

International Application No EP2004/050519

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A01H5/00 C12N15/82 A01H5/10 According to International Patent Classification (IPC) or to both national classification and IPC Minimum documentation searched (classification system followed by classification symbols) IPC 7 C12N Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, BIOSIS, WPI Data, EMBL C. DOCUMENTS CONSIDERED TO BE RELEVANT Category ° Citation of document, with indication, where appropriate, of the relevant passages Relevant to claim No. X 1-7, WO 98/36084 A (AGRICOLA TECH INC) 20 August 1998 (1998-08-20) 9-11. 14-22 page 2, line 11 - line 23 Υ 8,23,24 page 9, line 7 - line 14 page 35, line 6 - page 37, line 12 X LUCCA PAOLA ET AL: "Approaches to 1,4-7,9, improving the bioavailability and level of 10,14-20 iron in rice seeds" JOURNAL OF THE SCIENCE OF FOOD AND AGRICULTURE, vol. 81, no. 9, July 2001 (2001-07), pages

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X Further documents are listed in the continuation of box C. X Patent family members are listed in annex.							
A docume consider filling of the consider of the constant of	nt which may throw doubts on priority claim(s) or is cifed to establish the publication date of another n or other special reason (as specified) ant referring to an oral disclosure, use, exhibition or	 "T" later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed Invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family 					
Date of the	actual completion of the international search	Date of mailing of the International search report					
2	O September 2004	07/10/2004					
Name and r	nailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Loubradou, G					

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828-834, XP001183265 ISSN: 0022-5142

paragraph 3

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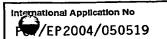
paragraph - page 833, left-hand column,

8,23,24

International Application No
PT / EP 2004 / 050519

(Continua	ation) DOCUMENTS CONSIDERED TO BE RELEVANT	
tegory *	Citation of document, with Indication, where appropriate, of the relevant passages	Relevant to claim No.
	DATABASE EMBL 7 November 1991 (1991-11-07), TAKAHASHI: "A. thaliana AtMT-1 mRNA for metallothionein-like protein" XP002297021	11-13
	Database accession no. X62818 the whole document	8,23,24
	ZHOU J ET AL: "STRUCTURE, ORGANIZATION AND EXPRESSION OF THE METALLOTHIONEIN GENE FAMILY IN ARABIDOPSIS" MOL. GEN. GENET, XX, XX, vol. 248, 1995, pages 318-328, XP000907576	11-13
•	the whole document	8,23,24
	PATER DE B S ET AL: "THE PROMOTER OF THE RICE GENE GOS2 IS ACTIVE IN VARIOUS DIFFERENT MONOCOT TISSUES AND BINDS RICE NUCLEAR FACTOR ASF-1" PLANT JOURNAL, BLACKWELL SCIENTIFIC PUBLICATIONS, OXFORD, GB, vol. 2, no. 6, 1992, pages 837-844, XP000907326 ISSN: 0960-7412 cited in the application abstract	
	COBBETT CHRISTOPHER ET AL: "Phytochelatins and metallothioneins: roles in heavy metal detoxification and homeostasis." ANNUAL REVIEW OF PLANT BIOLOGY. 2002, vol. 53, 2002, pages 159-182, XP002297019 ISSN: 1543-5008 cited in the application the whole document	
	SUH M C ET AL: "Cadmium resistance in transgenic tobacco plants expressing the Nicotiana glutinosa L. metallothionein-like gene." MOLECULES AND CELLS. 31 DEC 1998, vol. 8, no. 6, 31 December 1998 (1998-12-31), pages 678-684, XP009036622 ISSN: 1016-8478 the whole document	

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT Category Catation of document, with Indication, where appropriate, of the relevant passages Relevant to claim No.								
Category °	Citation of document, with Indication, where appropriate, of the relevant passages							
A	KAERENLAMPI S ET AL: "Genetic engineering in the improvement of plants for phytoremediation of metal polluted soils" ENVIRONMENTAL POLLUTION, BARKING, GB, vol. 107, no. 2, 2000, pages 225-231, XP002287818 ISSN: 0269-7491 the whole document							
A	THOMAS JOHN C ET AL: "Yeast metallothionein in transgenic tobacco promotes copper uptake from contaminated soils." BIOTECHNOLOGY PROGRESS, vol. 19, no. 2, 21 November 2002 (2002-11-21), pages 273-280, XP002297020 ISSN: 8756-7938 page 276, right-hand column, paragraph 4							
A	EVANS KATHERINE M ET AL: "Expression of the metallothionein-like gene PsMT-ALPHA in Escherichia coli and Arabidopsis thaliana and analysis of trace metal ion accumulation: Implications for PsMT-ALPHA function" PLANT MOLECULAR BIOLOGY, vol. 20, no. 6, 1992, pages 1019-1028, XP009036607 ISSN: 0167-4412 the whole document							

2

Information on patent family members

International Application No PEP 2004/050519

Patent document cited in search report		Publication date		Patent family member(s)	Publication date	
WO 9836084	Α	20-08-1998	AU WO	6152998 A 9836084 A2	08-09-1998 20-08-1998	

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(54) Title: PLANTS HAVING MODIFIED GROWTH CHARACTERISTICS AND METHOD FOR MAKING THE SAME

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(57) Abstract: The present invention concerns a method for modifying the growth characteristics of plants by modulating expression in a plant of a nucleic acid sequence encoding a metallothionein and/or modulating activity in a plant of a metallothionein. The invention also relates to transgenic plants having modified growth characteristics, which plants have modulated expression of a nucleic acid encoding a metallothionein.



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